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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/732,839	12/10/2003	Chayan Mitra	134446	6720

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EXAMINER

WILLE, DOUGLAS A

ART UNIT PAPER NUMBER

2814

DATE MAILED: 03/10/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/732,839

Applicant(s)

MITRA ET AL.

Examiner

Douglas A. Wille

Art Unit

2814

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 10 December 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-24 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-24 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 10 December 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>1203</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1 – 3 and 9 - 11 are rejected under 35 U.S.C. 102(b) as being anticipated by Nishizawa.

3. With respect to claim 1, Nishizawa shows (see cover Figure) a transistor with a graded channel 12, 13 with two doping levels (column 3, line 35).

4. With respect to claim 2, region 12, near source 11 is more heavily doped than region 13.

5. With respect to claim 3, the gate 15 is along the side of 12, 13.

6. With respect to claim 9, Nishizawa et al. show (see Figure 7) a gate region 21 indicated as p+ and since the n+ region is $5(10)^{17} - 1(10)^{19}$ the p+ region would be the same.

7. With respect to claim 10 and 11, Nishizawa et al. show that with materials such as GaAs high frequency operation is possible (column 8, line 44)

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Claims 6 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nishizawa.

Art Unit: 2814

10. With respect to claim 6, Nishizawa shows that the doping of layer 13 can be as low as 10^{14} and layer 12 can be as high as 10^{19} . With this large arrange it would be obvious to include a third layer to spread the doping level and avoid electric field crowding.

11. With respect to claim 7, the doping levels are within the claimed range.

12. Claims 1 – 9, 12 – 20, 23 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hatakayama et al. in view of Chen et al.

13. With respect to claim 1, Hatakayama et al. show (see cover Figure) a SIT with a source 3a, channel region 2 and drain region 1 and the channel region is uniformly doped. Chen et al. show that for a vertical structure graded doping of the channel provides operating advantages [0008] and can be in a SiC device [0028]. It would be obvious to use the graded doping shown by Chen et al. in the Hatakayama et al. device for the advantages shown.

14. With respect to claim 2, Chen et al. show that the doping is high at the source end.

15. With respect to claim 3, the gate region is along a sidewall.

16. With respect to claims 4 and 5, the Hatakayama et al. material SiC.

17. With respect to claim 6, the Chen et al. doping is continuous.

18. With respect to claim 7, Chen et al. show (see Figure 5) the doping varying from mid $(10)^{17}$ to mid $(10)^{18}$ but other doping densities can be used to design a specific channel conductivity and would be obvious.

19. With respect to claim 8, Hatakayama et al. show the source doping as $(10)^{20}$ [0063] and the drain doping as $(10)^{19}$ [0071] but it would be obvious to use other doping densities as part of the design process.

Art Unit: 2814

20. With respect to claim 9, the Hatakayama et al. gate doping is $(10)^{18}$ [0066] but other doping densities would be obvious as part of the design process.
21. With respect to claims 12 and 13, SiC is inherently a high breakdown voltage material.
22. With respect to claim 14, any application would be obvious.
23. With respect to claim 15, Hatakayama et al. show a SIT [0005].
24. With respect to claim 16, Hatakayama et al. show (see cover Figure) a SIT with a source 3a, channel region 2 and drain region 1 and the channel region is uniformly doped. Chen et al. show that for a vertical structure graded doping of the channel provides operating advantages [0008] and can be in a SiC device [0028]. Chen et al. show that the doping is high at the source end. It would be obvious to use the graded doping shown by Chen et al. in the Hatakayama et al. device for the advantages shown.
25. With respect to claim 17, the Chen et al. doping is continuous.
26. With respect to claim 18, Chen et al. show (see Figure 5) the doping varying from mid $(10)^{17}$ to mid $(10)^{18}$ but other doping densities can be used to design a specific channel conductivity and would be obvious.
27. With respect to claim 19, Hatakayama et al. show the source doping as $(10)^{20}$ [0063] and the drain doping as $(10)^{19}$ [0071] but it would be obvious to use other doping densities as part of the design process.
28. With respect to claim 20, the Hatakayama et al. gate doping is $(10)^{18}$ [0066] but other doping densities would be obvious as part of the design process.
29. With respect to claims 23 and 24, SiC is inherently a high breakdown voltage material.

Art Unit: 2814

30. Claims 10, 11, 21 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hatakayama et al. in view of Chen et al. and further in view of Farb et al.

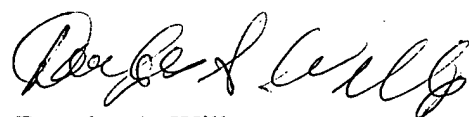
31. With respect to claims 10, 11, 21 and 22, Hatakayama et al. do not show the operating frequency of the device but Farb et al. show that for a similar device (see cover Figure) operation at frequencies up to several GHz are possible.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Douglas A. Wille whose telephone number is (571) 272-1721. The examiner can normally be reached on M-F (6:15-2:45).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (571) 272-1705. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Douglas A. Wille
Primary Examiner